

AD-A181 880 COST EFFECTIVE APPLICATION OF LOGISTICS SUPPORT  
ANALYSIS PHASE 2 RESULTS(U) CACI INC-FEDERAL  
GAITHERSBURG MD 16 MAR 87 BRMC-86-5022-2 F/G  
UNCLASSIFIED F33615-86-C-5022

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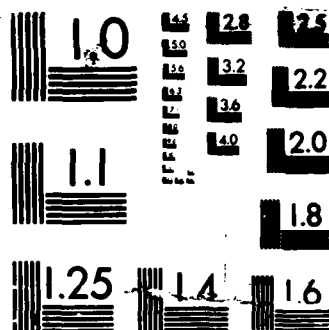
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AD-A181 880

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# COST EFFECTIVE APPLICATION OF LOGISTICS SUPPORT ANALYSIS

WRITTEN REPORT OF PHASE II RESULTS  
(CDRL#4)

Prepared for:

Aeronautical Systems Division  
Wright-Patterson AFB, Ohio 45433-6503

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CONTRACT NO. F33615-86-C-5022

Submitted by:

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Gaithersburg, Maryland 20878

16 March 1987

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## EXECUTIVE SUMMARY

ASD/PMRRA has terminated Contract No. F33615-86-C-5022 "Cost Effective Application of Logistics Support Analysis" at the conclusion of Phase II. (Attachment 2).

### Literature Search and Interview Process:

Through the Phase II effort, 108 articles were reviewed to establish the linkage between cost and benefits of Logistics Support Analysis (LSA). The literature search failed to reveal any sound basis for establishing a cause/effect relationship between dollars spent on LSA and benefits derived. The preponderance of the literature focused in on parts or pieces of the LSA process. Those references that purported to tie benefits to costs were found lacking in scientific research techniques to the extent that the findings could not be generalized to develop an overall approach. A complete bibliography is attached as Attachment 1. Prior status reports provided synopsis of each reference.

Formal contact was made with 24 people during the interview process and many other people were contacted informally to gather data and insights. What became evident through the interview process was that the total understanding of the LSA process centered in a very small number of people. Some well placed individuals felt that establishing the link between LSA costs and benefits was impossible. Our conclusion was that the task is not impossible, but that there are impediments in the acquisition process, contract cost structuring, cost reporting and proprietary information areas that significantly cloud the true cost of LSA.

On the benefit side, there was limited documentation concerning benefits. This was perceived to be caused by two factors. First, contractual language did not generally require any documentation and second, the experience level of personnel (government and contractor) doing hands-on LSA was low -- one source estimated the number to be under three years. Our limited sample of projects reviewed indicated this level was even lower. The documentation that was available consisted of lists of benefits with two general problems:

1. The benefits were not tied to the cost of doing the LSA that generated the benefit.
2. It could not be proven that the benefit would not have occurred independent of the LSA process (e.g., through some other integrated logistic support or engineering analysis).

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## FINDINGS:

### Past State

According to Woodland (1984), "Government efforts to infuse consideration of the complex constraints of logistics support into the engineering design process have been underway for many years." Citing Fulford, Woodland suggests:

As early as 1964, DOD Directives and instructions established a requirement for each service to implement some type of Logistics Support Analysis Program. This early attempt to formulate government policy was met with separate efforts by each of the services to develop and implement the DOD Directive. Unfortunately, there was no collective effort to accomplish objectives and no unified standard specifying how LSA was to be achieved. Within Air Force circles, the Ballistic Systems Division (BSD) prepared a detailed set of LSA requirements for the Minuteman Program. The Navy similarly developed Maintenance Engineering Analysis (LSA equivalent) and applied the process to both the F-4 and F-111 Programs. Air Force attempts to apply the LSA processes initially met with little success.

Recognizing that the LSA process of the 1960s was lacking the requisite effectiveness, the services decided in the early 1970s to establish a single source of guidance for applying LSA (Woodland, 1984). Though not as successful as hoped, this effort did provide some measure of integrated investigation into the LSA process. Also resulting from this effort was MIL-STD-1388-1A, written to correct some of the inadequacies of MIL-STD-1388-1.

Generally the Air Force Request for Proposal (RFP) is the first communication with industry that contains requirements for LSA. The RFP is sent to potential contractors requesting a proposal describing how each contractor would accomplish the stated government requirements. Included in the RFP are factors such as Meantime Between Maintenance (MTBM) that communicate system goals to defense industry participants. Citing AFLC/AFSC Pamphlet 800-34, Woodland (1984) suggests:

The responding contractor firms must describe (often in an LSA plan) how the contractor proposes to apply the LSA process and how the systems engineering process will incorporate the functions of the LSA program. The contractor's

response must be descriptive enough to communicate all the details of the LSA program and their applicability to total system objectives. Subsequent evaluation for contract award is based partially on past experience but primarily on how well the contractor understands and intends to implement the LSA process.

The next major milestone in the LSA process is placing LSA on contract (Woodland, 1984). According to Woodland (1984):

While the negotiated contract marks the beginning of contractor responsibility, it does not mark the beginning of the analysis process. Some form of support analysis, at least at a topical level, is usually conducted during the concept exploration phase. Upon contract award during full scale development, the contractor should be provided with any and all logistics information that defines the expected support posture.

Flexibility is needed when determining which LSA tasks fit a specific program. This notwithstanding, some activities are required, regardless of the type of acquisition (Woodland, 1984). Citing the Air Force guide for Supportability Analysis and Supportability Analysis Record, Woodland (1984) suggests that "support task requirements be identified by three analysis techniques: (1) detailed review of system functional support requirements; (2) failure modes, effects, and criticality analysis (FMECA); and (3) reliability centered maintenance (RCM) analysis."

Woodland believes the Failure Modes, Effects, and Criticality Analysis to cause the most confusion. He states (1984):

In the performance of the FMECA, the contractor must identify the various possible modes of failure for a piece of equipment and then determine the effect or criticality of such a failure. This kind of analysis is central to the LSA process. Without proper identification of possible failure modes, there is little chance of documenting and analyzing the support required to maintain an operational system.

Citing further from AFLC/AFSC Pamphlet 800-34, and the Guide for Supportability Analysis and Supportability Analysis Record, Woodland (1984) states:

After final contract award, there is a 30-45 day period during which the Air Force is required to meet with the contractor to discuss the significance of the LSA program within the contractor's systems engineering process. The guidance conference meeting provides industry with an opportunity to clarify Air Force support concepts and fully explain their approach to satisfying LSA program requirements. Specifically, the guidance conference provides a means of establishing initial LSA procedures and conditions under which documented results may be reviewed and validated. There is also ample opportunity to discuss how the LSA data will be passed to those authorized government agencies who request summary reports. Contractors should identify both organizational and functional management responsibilities for LSA and establish the level of indenture (work breakdown structure) to which the support analysis is to be performed. Lastly, both parties must agree to the equipment items that will initially be identified as analysis candidates. From this point forward, the contractor assumes major responsibility for the performance of LSA tasks and the generation of acceptable data products.

The last major phase of activity involves conducting the LSA program as described in the approved contract (Woodland, 1984). Though this phase may appear to be anticlimactic, reality dictates otherwise. Essentially an iterative process, LSA requires the analyst to decide when the logistics influence on design must cease so that system support requirements can be established. Compounding the difficulty is the requirement to make decisions affecting the long term in an environment of uncertainty. This notwithstanding, LSA does offer a method to make efficient use of finite resources. Woodland (1984), stated it well:

In summarizing the LSA process, it is sufficient to say that it is more than just an analysis tool; LSA represents a methodology that provides an integrated approach to the definition and quantification of a system's logistics support requirements. LSA provides a means unlike others to use design parameters in determining the actual numbers of required spares, skill requirements, technical data, and personnel. In short, the synthesis of each



iteration of LSA analyses is accomplished toward the eventual achievement to one singularly important goal--cost effective support for design.

### Current State

The LSA process goal, as seen from the background material, is to produce cost effective support for design. Were there unlimited resources and time in which to synthesize and evaluate quantitative and qualitative data through an iterative process resulting ultimately in the "best design" for the cost, there would be little need for this study. Reality, however, suggests otherwise in view of the fact that the LSA process requires both resources and time. Thus, the not uncommon problem reveals itself--in an environment of limited resources how to expend resources to the "best" advantage. This suggests that expenditures on LSA, though ultimately producing an end item representing a series of rational selections from alternatives, might themselves be so exorbitant as to make the cure worse than the disease. Stated another way, LSA costs must be weighed with other costs to arrive at the preferred mix of end system costs.

It should be noted that "preferred does not necessarily imply optimal as the operational requirements and maintenance concept may not permit true optimization" (Blanchard, 1986, p.141). Quoting again from Blanchard (1986, p.141) "Preferred does imply the best among a number of alternatives within the given constraints." This suggests that even though LSA helps personnel select the "best" alternative, finite resources necessitate evaluating the cost-benefit ratio of the LSA process. Essentially it's this thought that produced this study's charter--"to conduct research into a methodology for measuring cost benefits in applying the formal Logistics Support Analysis (LSA) of MIL-STD-1388 on a system or equipment acquisition." Stated succinctly--with limited resources, which part(s) of the LSA process has the likelihood of greater payoff.

The project was divided into three phases: (1) Update the management plan, attend a program initiation briefing, and organize resources to accomplish Phases II and III, (2) Investigate through literature research, on-site acquisition program office interview, USAF Logistics/Management regulation review and the requirements of MIL-STD-1388 those factors that provide a data

base for building a cost benefits methodology, and (3) Provide a cost benefits methodology for applying LSA....

Phase I, was administrative while Phase II marked the start of tangible efforts to satisfy the study's charter. Researching the literature, though instructive, provided no substantive foundation for exploring cost benefit relationships. Though 108 documents were studied, the core problem of a cost benefit methodology generalizable to a population was not delineated. The same results emanated from personal contact. Trips were made to Hanscom AFB, Massachusetts, Wright-Patterson AFB, Ohio, Fort Lee, Virginia, Lexington Army Depot, Kentucky, and Falls Church, Virginia. Telecons were held with others when a trip seemed not cost effective. The following people became part of the circle of information pertinent to this project:

Mr. Robert Bowes	ESD
Capt. Dennis Smith	ASD
Mr. Jim Harris	AFALC
Mr. Enrique Hernandez	AD
Mr. Gene Barts	Warner-Robins ALC
Mr. Dave McChrystal	then at Lexington Army Depot
Ms. Andrea Wright	AFALC
Mr. Robert Cunningham	Lexington Army Depot
Mr. Alphonso Wilson	Lexington Army Depot
Mr. Dan Fisher	San Antonio ALC
Lt. Col. Joseph McNeer	Program DPML
Mr. J.L. Balcom	ARINC
Capt. Terry Martin	ESD
Commander James Holt	AFIT
Capt. R. Andrews	AFIT
Col. Bush	ESD
Ms. Chris Fisher	ESD
Ms. M.K. Cronin	ESD
Mr. Dick Lemire	ESD
Mr. Ed Herger	ESD
Ms. Hazel Palmer	ESD
Mr. Bob Morris	ARINC
Mr. J. Arcieri	WSI&A
Mr. B. Morris	Rockwell

Though differences of opinion were evident on whether a cost-benefit methodology could be developed, a typical view was that it was near impossible.

### Observations

Opinions of LSA value varied among persons interviewed. On the one extreme, some personnel felt LSA was like a black hole consuming input resources (time, material, and personnel) with little output to justify the expense (often not known). Several examples were candidly discussed during the interview process. Examples are as follows:

1. On one huge program (\$300M+), the LSAR tape from one phase of the DSARC process was delivered to the government and there was no computer resource available to verify data on the tape.
2. One large program (\$300M+) had an engineering data base that was used by the prime contractor to perform engineering analysis -- the LSA Plan referenced the system. Sources stated that the LSAR deliverables appeared to be a backfill and that the iterative update of the LSAR data base data was noted as questionable.
3. One large program required full LSA MIL-STD-1388-1A and 2A on a 95 percent off-the-shelf with no A sheet data or tailoring provided to the contractor. The LSA process was being worked in reverse. Instead of LSAR being used to help generate technical and training data -- commercial data was being fed back into the data base from commercially published manuals to generate the LSAR deliverable reports.
4. On one large program, major engineering changes (ECPs) were being evaluated. LSAR deliverables were stacked in boxes with no efficient way to extract needed data nor any way to verify the iteration or currency of the data to the system final design.

At the other extreme, many personnel interviewed expressed strong support of LSA. Many of these same people had documented various strategies for improving LSA implementation and weaving these processes into several of the ongoing logistics modernization programs for the various services. Flaws in the implementation of LSA were documented in lessons learned, but the degree of benefits derived appeared to be diminished by the low experience level of personnel doing the hands-on LSA implementation.

## Future State

Currently, there is not sufficient visibility over LSA costs or adequately documented benefits to make the tie as envisioned under this contract. However, during the course of our study efforts it became evident that there was a strong tie between the data gathered in the LSA process and the detailed data that is required to drive Life Cycle Cost (LCC) model estimates. Thus, from an analytical process, it is possible to work backwards from an LCC model and determine which inputs from the LSA have the greatest potential impact on LCC. Results of preliminary analysis of an LCC model indicated the model was sensitive to certain inputs and these inputs could be arrayed from having a significant impact (controllable) on LCC to those that either are uncontrollable or controllable but have minimal impact on cost. Our Phase III Approach was to recommend that this be the method determining the benefits derived from LSA -- Selecting those LSA tasks that have the greatest potential impact on LCC drivers tailored to the dollars available to conduct LSA. It would follow that programs having a longer Life Cycle or involving large dollar investments would most likely employ the majority of LSA tasks and those that have a shorter Life Cycle or involving small dollars would have minimal LSA tasks. The selection of the LSA tasks would be based on the potential influence of that task on the sensitive drivers in the LCC models.

The typical approach to LSA is to buy LSA task completion from the contractor or do it "in-house". From this LSA task comes an LSA Record (LSAR) and, eventually, end item support. If the process is done early enough in the end item's life cycle, the design of the end item can be affected--thus producing a "better" end item. "Better" could be measured by several criteria; e.g., initial cost, life cycle cost, performance, inter alia.

The problem of determining what is produced by the LSA task dollar has heretofore remained unsolved. To LSA devotees, all LSA tasks have merit and should be levied on the contractor--though not necessarily regardless of cost. To cost benefit devotees, the question of what the LSA money buys must be evaluated--and decisions made regarding the wisdom of expending the money. Thus, the state of LSA today is to spend money "up front" on LSA with the hope being that money will be saved later or that a "better" end item (in terms of supportability) will result. Figure 1 displays this concept.

# A TYPICAL APPROACH

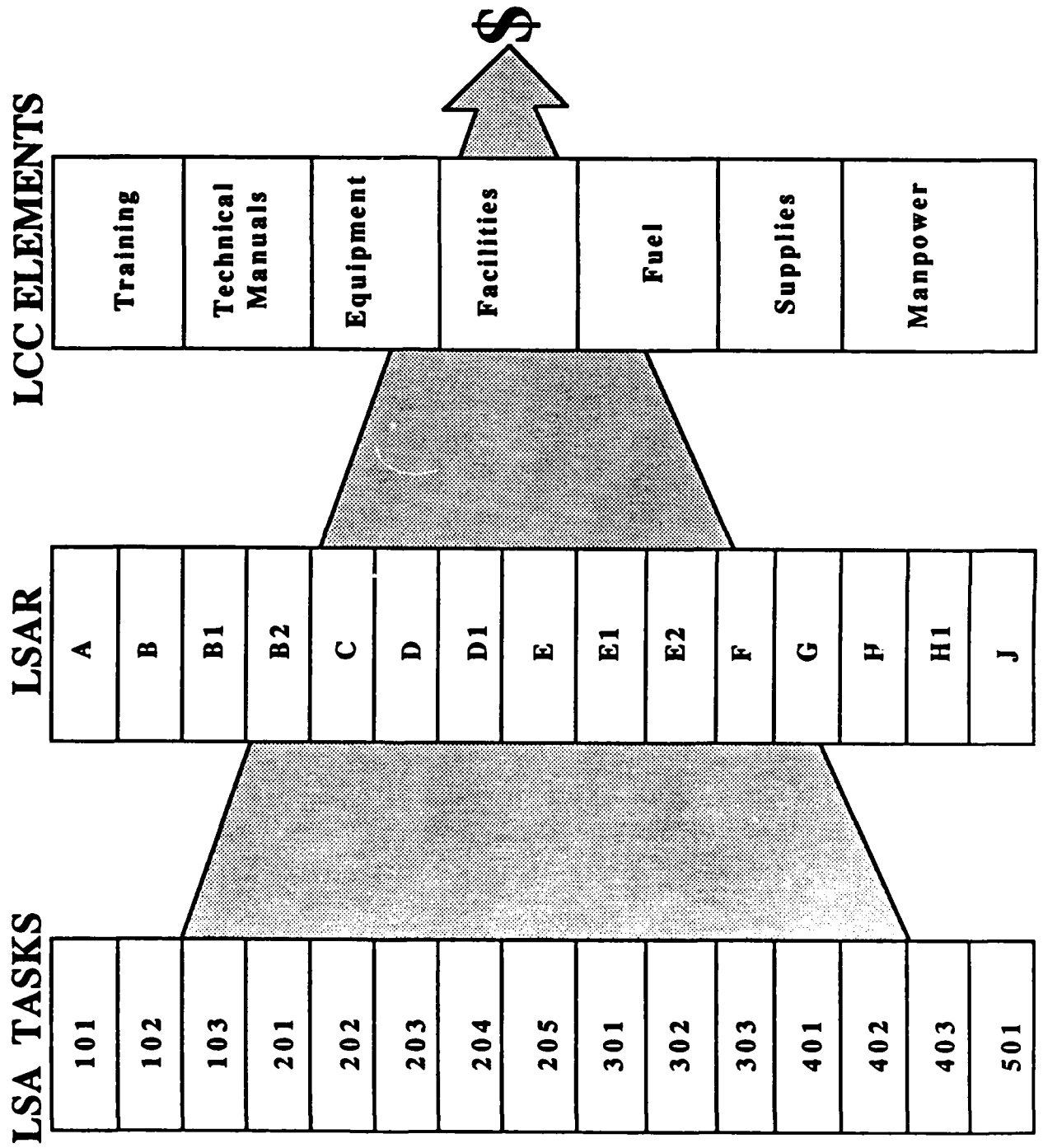


Figure 1

Our fruitless search for methodology and data with which to establish any financial relationships between LSA task cost and end item cost impelled us to seek other avenues to problem solution. Thus, our approach to finding financial relationships was to reverse the sequence; i.e., start with the end product and work back to the LSA Task. Figure 2 displays this concept.

One such indicator of end product cost is life cycle cost. Accordingly, the Air Force's ONSCOSTS (Operational and Support Cost) model was the basis for the relationship search. (CACI personnel put the ONSCOSTS' algorithms on its computer system.) Because the ONSCOSTS Model requires values for its variables of MTBM, labor rates, percentage of base repair (to mention only a few), we developed a model end product utilizing nearly all of ONSCOSTS formulae. This model system, replete with LRU's, levels of maintenance, MTBMs, costs, et cetera, helped reveal the "drivers" of life cycle costs.

Now knowing the life cycle cost elements, we "worked backwards" to a linking LSA Record (LSAR) data element. Following this came the task of linking LSAR data element to LSA task, thus linking LSA task to life cycle cost output. The next several paragraphs synopsise the foregoing stated process.

1. ONSCOSTS has seven major elements of cost: (1) Training, (2) Technical Manuals, (3) Equipment, (4) Facilities, (5) Fuel, (6) Supplies, and (7) Manpower. Concentrating for the moment only on the major cost element of supplies, further breakdowns into initial and recurring costs appear. Figure 3 displays these initial and recurring cost elements.

2. Examining the subelements of base spares (initial cost) and repair materials (recurring cost) discloses those ONSCOSTS data elements "feeding" their respective subelement costs. Figure 4 displays these data elements.

3. Figure 5 depicts the linkage between life cycle cost data elements; e.g., UNCO (unit cost), POHR (peak operating hours), inter alia, the LSAR or (other data) source, and the LSA (or other) task.

4. Continuing to use our model end item, we next generated "pie" charts. Figure 6 depicts percentages of initial total supplies costs consumed by provisioning, new inventory, base spares and pipeline spares.

# THE PROBLEM

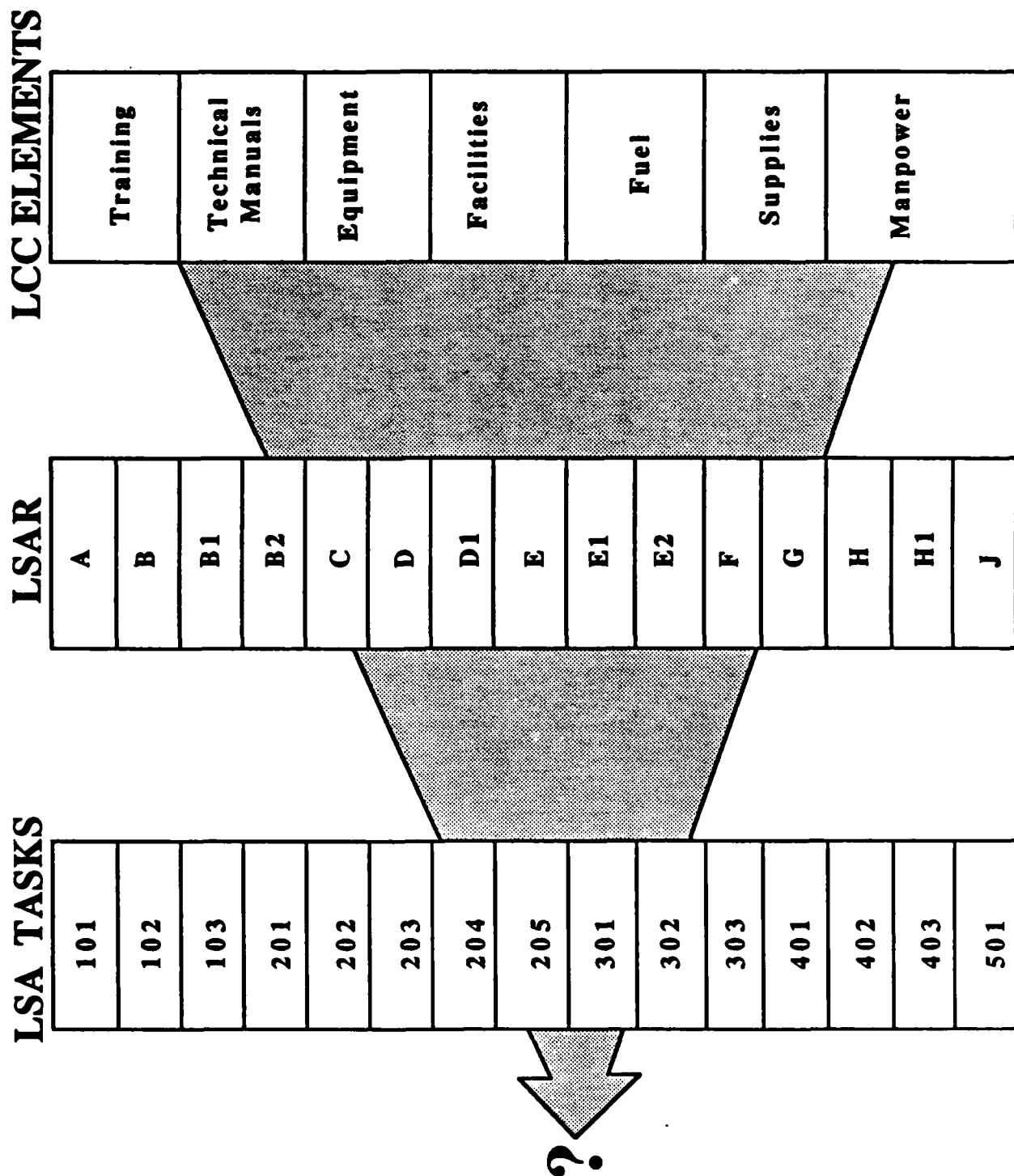
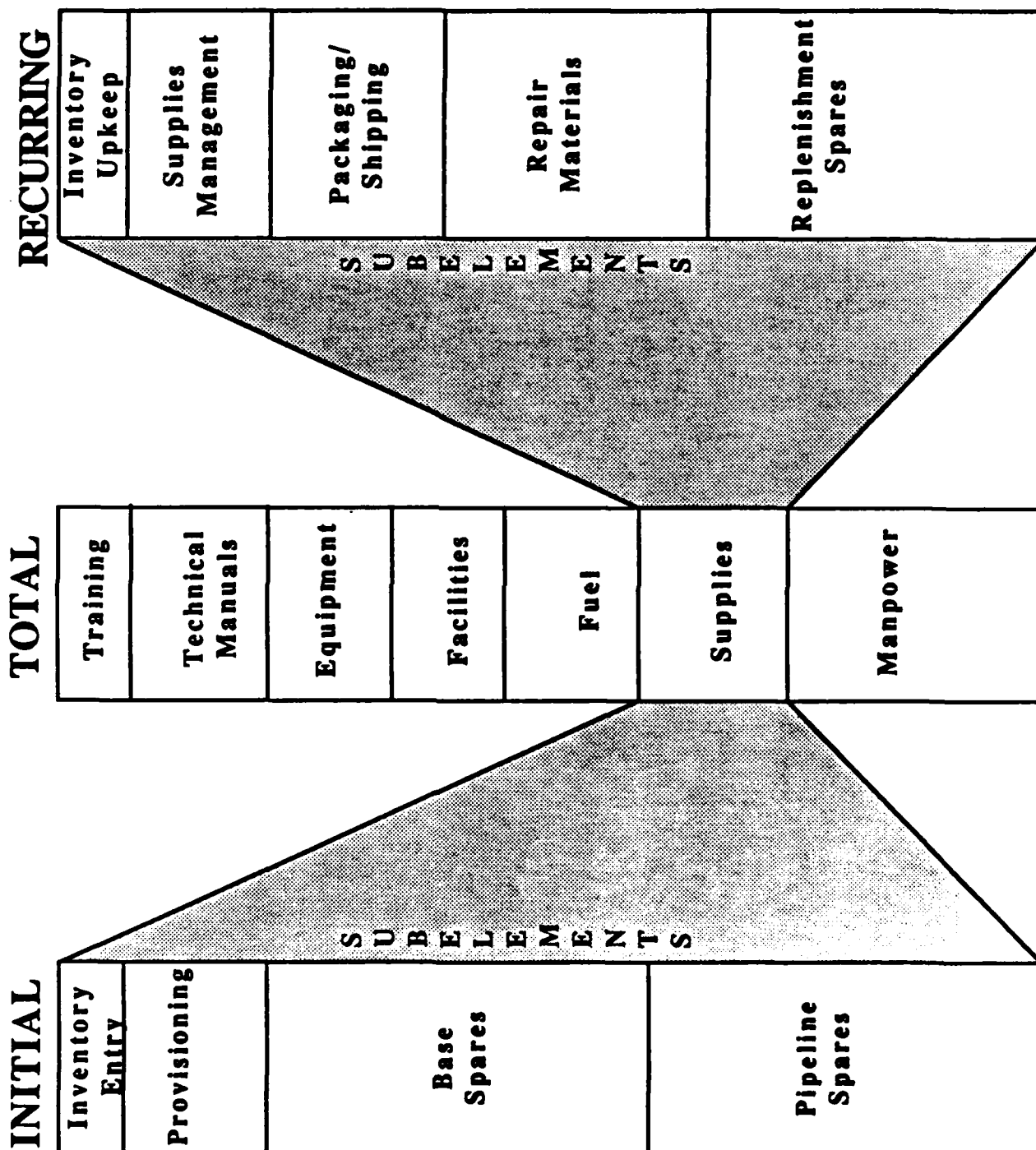


Figure 2

# **ELEMENTS OF COST**



**Figure 3**



# ELEMENTS OF COST

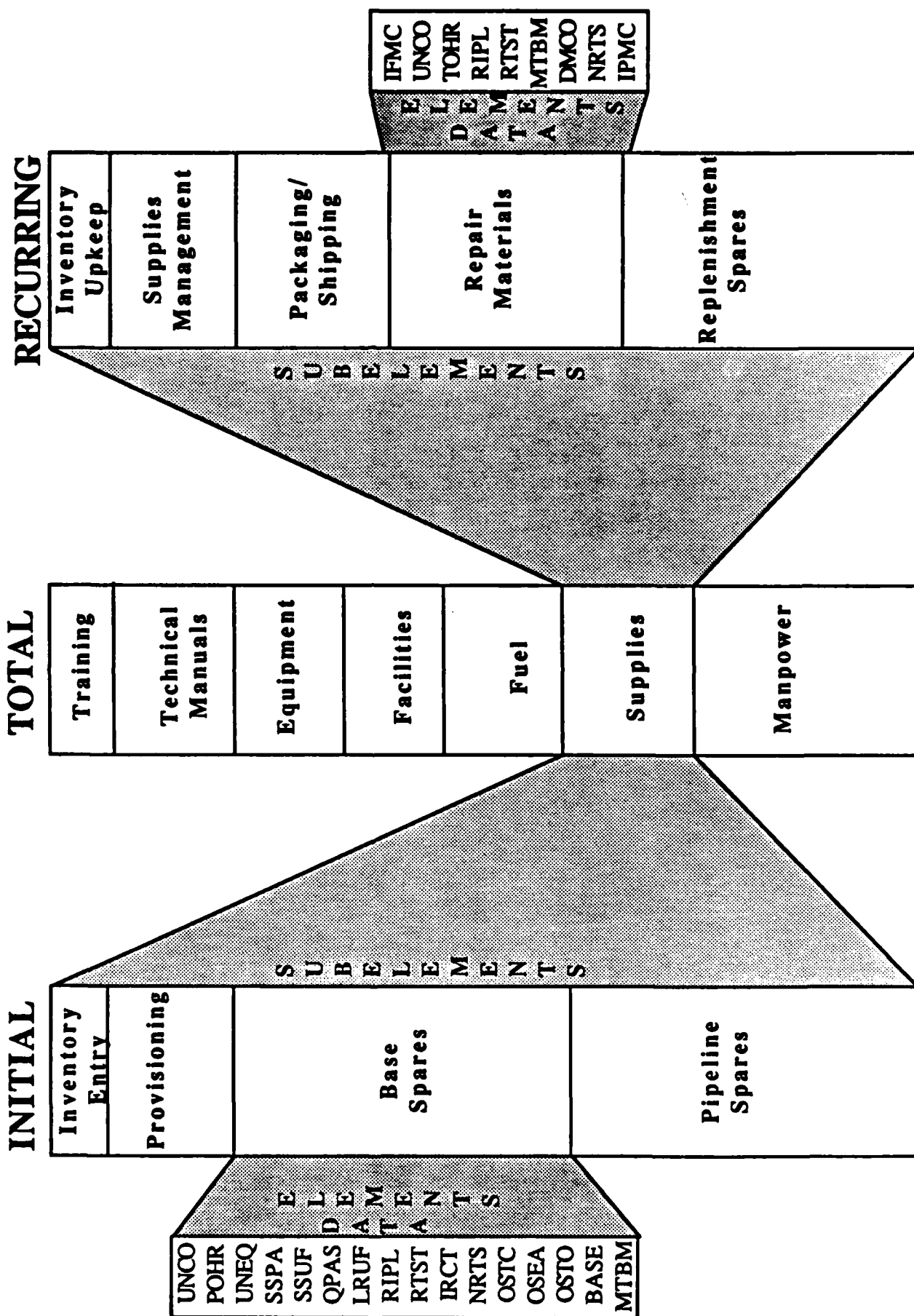


Figure 4

# LINKAGE

Life Cycle Cost Data Elements		LSAR (OTHER) DATA SOURCE		
Code	Translation	Sheet	Card	Block(s)
TOHR	Total Operating Hours	A	06	3
POHR	Peak Operating Hours	A	06	3/9
UNEQ	Number Operating Systems	A	06	15
BASE	Number Operating Locations	A	06	17
OSEA	Number Overseas Locations	A	06	17
OSTC	Order/Ship Time CONUS	(AFLCR 173-10)	(AFLCR 173-10)	(AFLCR 173-10)
OSTO	Order/Ship Time Overseas			
IRCT	Intermediate Repair Cycle Time			
MTBM	Mean Time Between Maintenance	H	13	6
RIPL	Percent On-Equipment Repair	B	07	5
DMCO	Depot Material Cost	C	06	3
		D	07	3/5/7/9
		H	02	6/7
IFMC	Intermediate Material Cost	D	07	3/5/7/9
		H	02	6/7
IPMC	On-Equipment Material cost	D	07	3/5/7/9
		H	02	6/7
UNCO	Unit Cost	H	02	7
QPAS	Quantity Per Assembly	H	10	17
RTST	Percent Intermediate Repair	H	11	12
NRTS	Percent Sent to Depot	H	12	8
SSPA	Subsystems Per System	(LSACIL)		
SSUF	Subsystem Utilization Factor			
LRUF	LRU Utilization Factor	A	03	5
		C	03	5

\* = Derived From

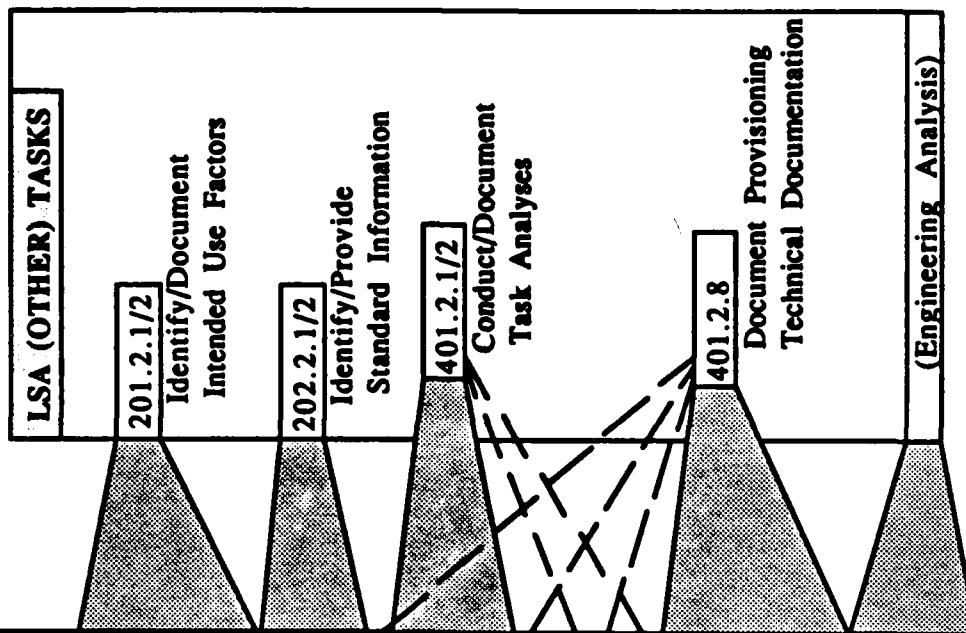
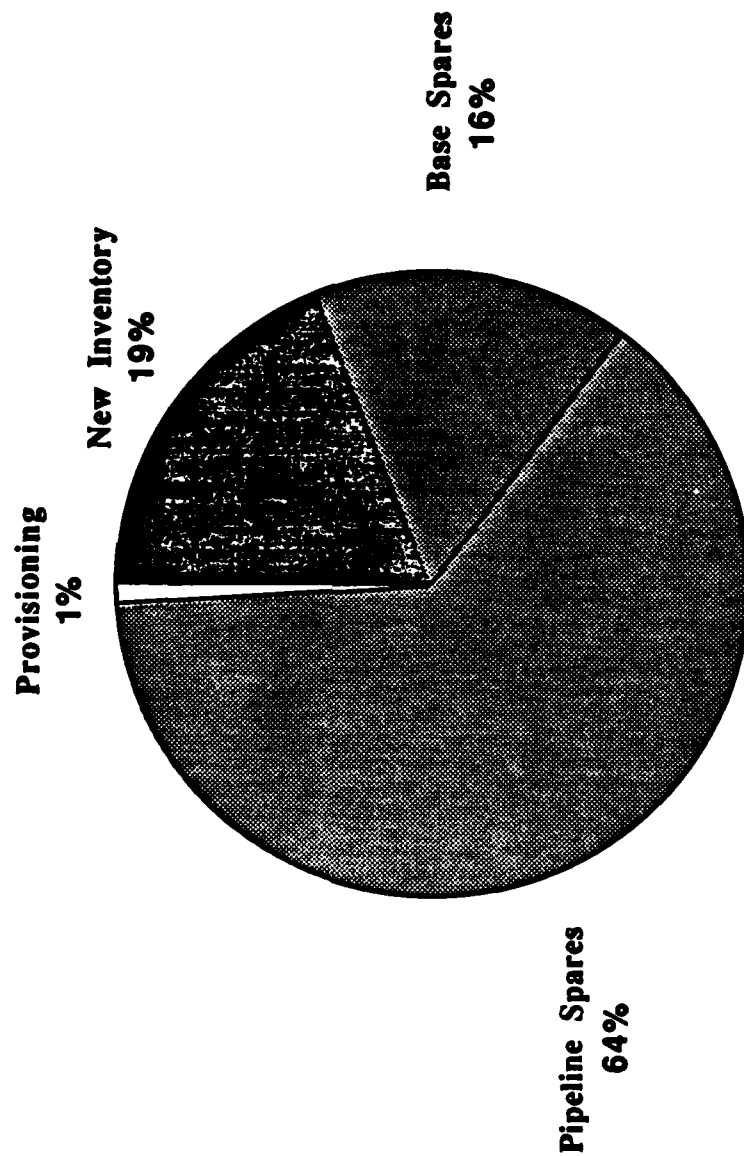


Figure 5

**Total Supplies Costs**  
**(Initial)**



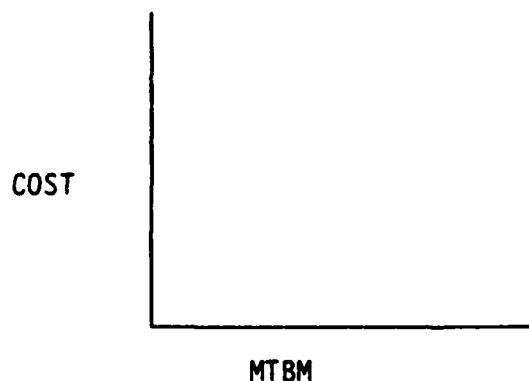
**Figure 6**

Figure 7 shows percentages of recurring total supplies costs consumed by inventory, replenishment spares, repair materials, packing and shipping, and management. Figure 8, Total Supplies Costs, shows percentages consumed by the nine supplies cost elements (see Figure 3) when calculated jointly.

5. Continuing to sum our model end item's life cycle costs, Figures 9, 10, and 11 depict initial, recurring, and jointly calculated percentages of five of those seven elements (see Figure 3) comprising our model end item's total costs. (Note: Our model end item had no fuel or facilities costs.)

As can be seen from Figure 11, supplies consumes 67 percent of our end item's total cost. Figure 4 reveals those data elements entering base spares' calculations, while Figure 5 shows the linkage between data element and LSA task. MTBM, for example, is a data element affecting base spares' calculations by being entered on the LSA "B" sheet, Card 07, Block 5. The "B" sheet, in turn, becomes a product of LSA Tasks 401.2.1 and 401.2.2.

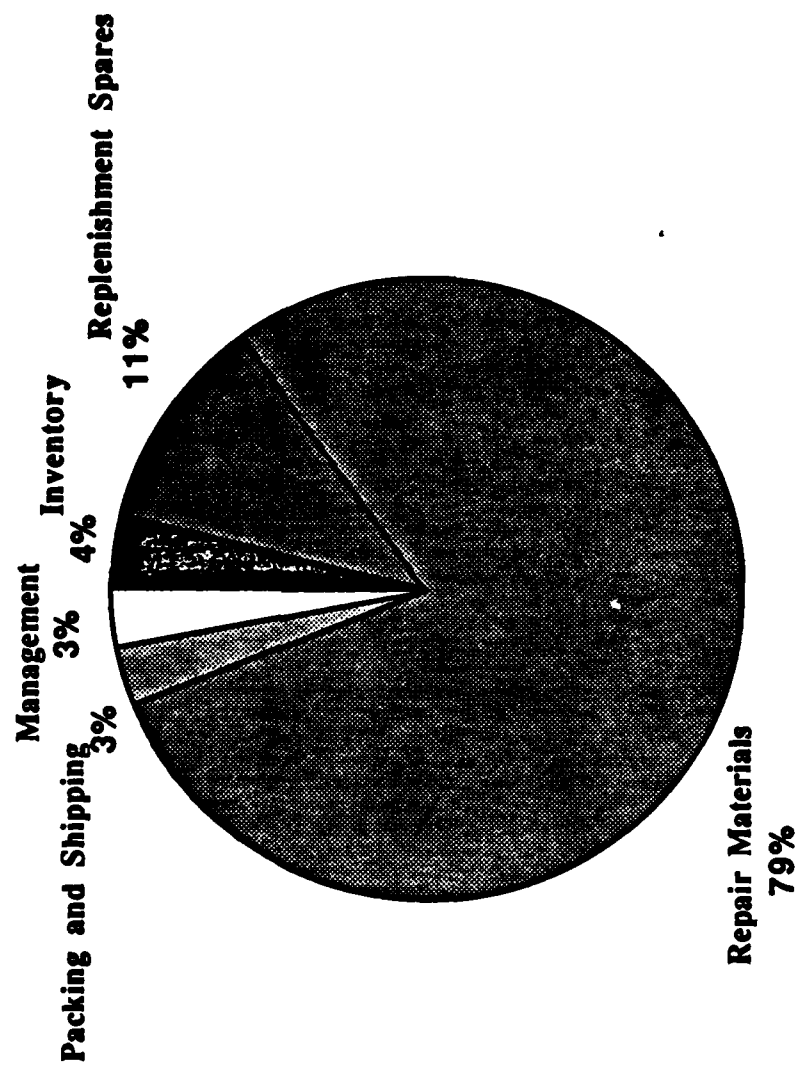
ONSCOSTS shows that MTBM possesses an inverse relationship to costs. Bearing the form  $Y = 1/X$ , X represents the independent variable of MTBM and Y is the dependent variable of cost. A plot of the equation is:



This plot suggests that as MTBM approaches zero, costs become inordinately high. On the other hand, as MTBM increases, a point is reached where costs decrease very little for each unit increase in MTBM.

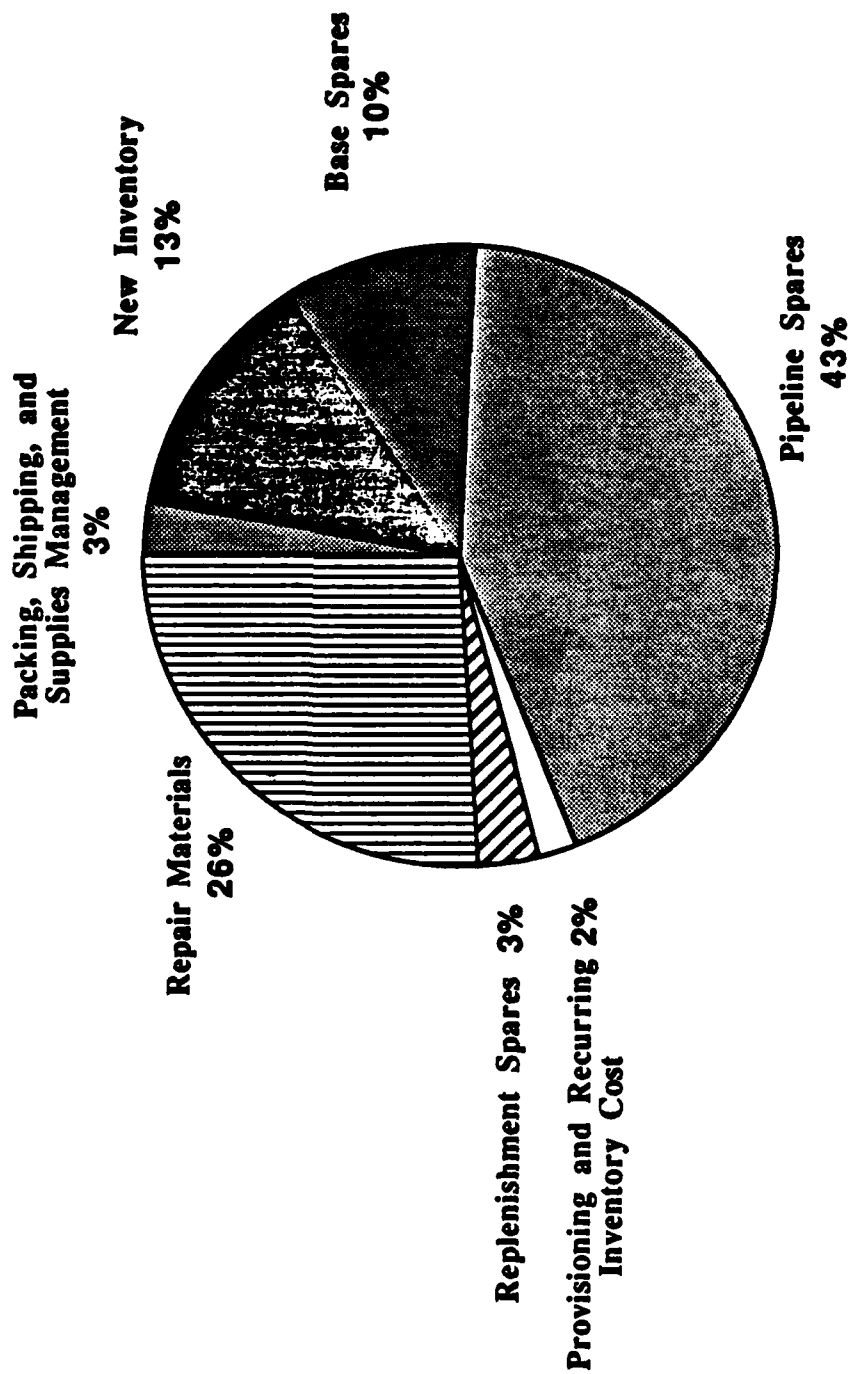
If there were a minimum point on the curve, the first derivative of the curve (with respect to X) set equal to zero would reveal that minimum point. The

**Total Supplies Costs**  
**(Recurring)**



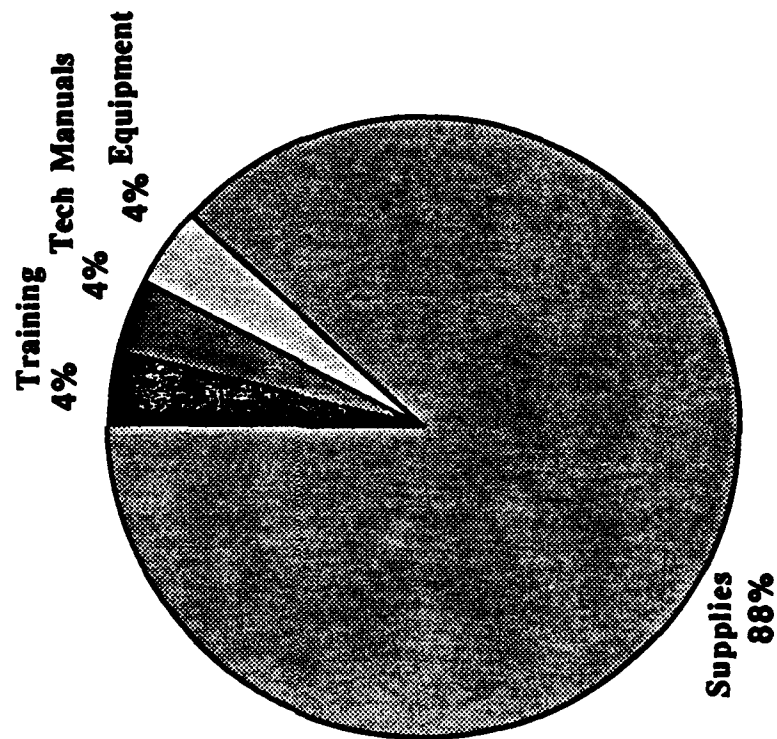
**Figure 7**

**Total Supplies Costs**  
**(Initial and Recurring)**



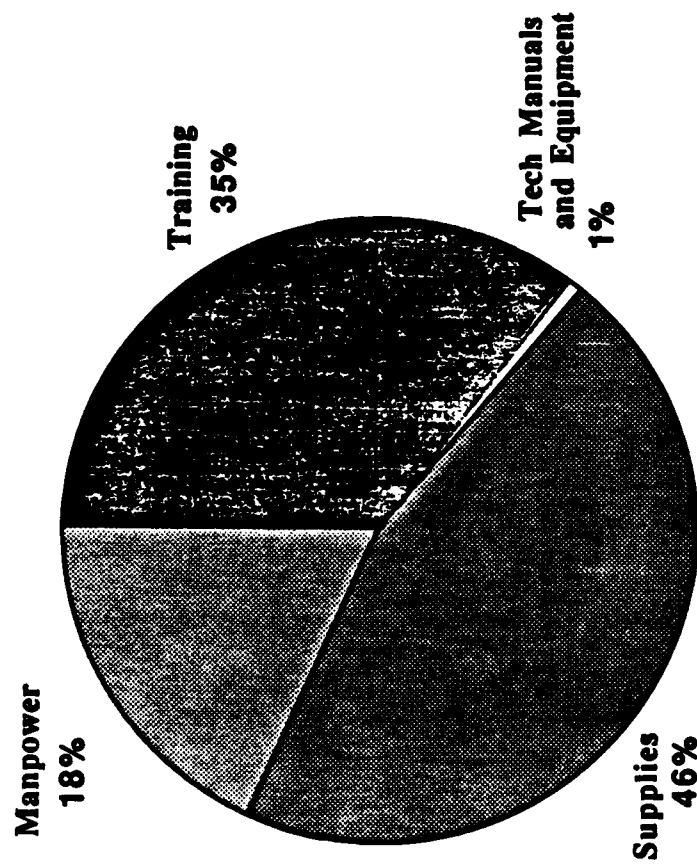
**Figure 8**

**Total Costs**  
**(Initial)**



**Figure 9**

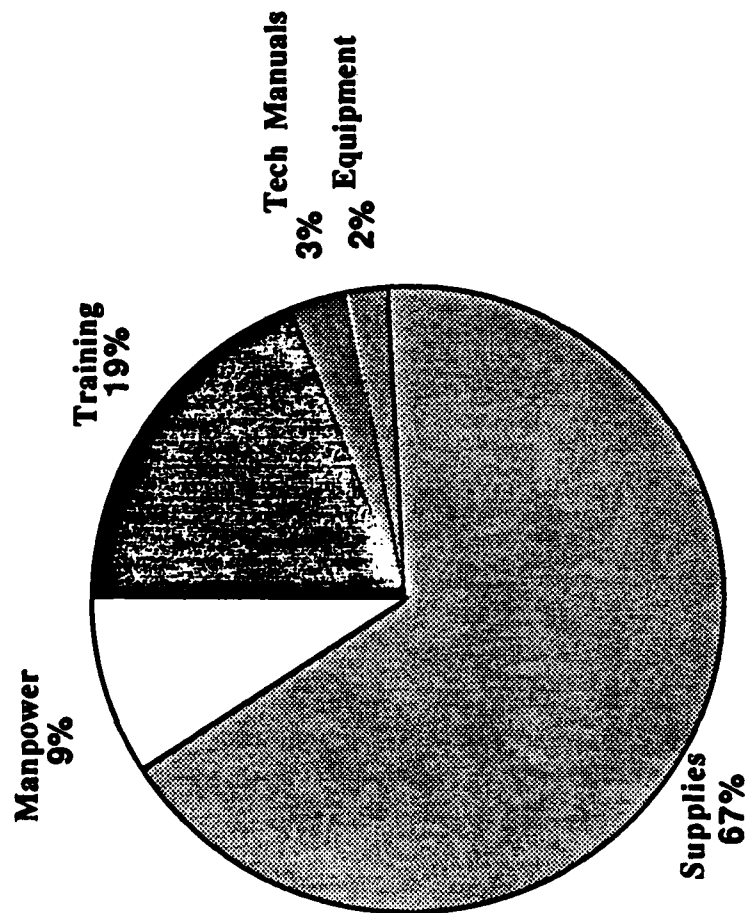
**Total Costs**  
**(Recurring)**



**Figure 10**



**Total Costs**  
**(Initial and Recurring)**



**Figure 11**

absence of a minimum point suggests that setting the equation's first derivative equal to one, for example, would reveal that point on the curve where a unit decrease in cost equals a unit increase in MTBM--that is, a line tangent to the curve at that point has a slope of one.

Looking at the cost-MTBM curve, it seems intuitively obvious that a line tangent to the curve, and possessing a slope of one or less, would be where the curve begins to "flatten." This suggests that LSA funds spent to find that point on the curve would be a wise investment--in view of the potential payoff. Knowing, also, that this factor is part of one of the total cost "pie's" major elements lends further credence to the wisdom of allocating funds to find this point on the cost curve.

Though the absence of "real" data required our use of model data for our calculations, the study's closure precluded the next step which would have been to search out "real" data with which to develop cost "pies." We believed that this step would have provided further opportunity to solve the elusive LSA cost-benefits problem.

For example: A rule-of-thumb might be that LSA task costs should be approximately one percent of the procurement costs. Thus, \$100 million in procurement should have LSA costs of one million dollars. To some, the million dollar LSA bill might be high. To the contractor, perhaps caught in a cost overrun situation, merely going through the motions of LSA offers an opportunity to return to a profit envelope. In any case, based on our study, too little money spent on LSA will not provide those break throughs resulting in the "best mix" of factors and resultant "best" life cycle cost relative to the input resource.

We believe that data is available which could help establish, initially, rules-of-thumb which could be refined over time. Furthermore, statistical analyses could be used in the refinement process. Failures, for example, can follow a Poisson probability distribution (Blanchard, 1986, pp.22-55). Thus for a range of possible values, expected values and confidence intervals can be derived. The Central Limit Theorem suggests that as the sample size increases the sample means will distribute normally regardless of the population

distributions (Zar, 1984, p. 86). This suggests that allowing a computer to randomly select samples of a given size from a population of logistics values is a means to model various scenarios of mean time between failures, LRU utilization factors, and repair times, to mention only a few. The fact of a resultant normal distribution of values enables calculation of standard deviations and confidence intervals. Applying these methods to costs, data on specific LSA tasks could be used to calculate expected values and ranges determined by how sure an analyst believed he needed to be to effectively allocate LSA funds. Regression analysis, multiple regression analysis, curve fitting techniques appear feasible, as does discriminate analysis, with its capability to determine membership groups through Bayes' posterior probability theories.

Despite a lack of substantive data on which to formulate a cost-benefit methodology, some preliminary recommendations are offered:

1. LSA requires:

- Dedicated supervision,
- Technically competent supervision,
- A method to gauge process effectiveness,
- Meetings with contractors 30-45 days after contract award.
- Analysts who understand salient features of:
  - Engineering
  - Spares
  - Support
  - Training
  - Manpower
  - Maintenance

2. RFPs should:

- Possess statements such as "LSA will be evaluated for price realism."
- Possess statements concerning how LSA will be used in design process.
- Request contractor recommend which LSA tasks should be used.

3. Cost Proposals should:

- Include detailed basis of estimates for LSA tasks whether used or not.
- Be evaluated by LSA knowledgeable people.

4. Technical Proposals should:

- Include LSA candidate item list.

5. Contracts should:

- Possess a separate line item to cost all LSA work.
- Possess a "deliverable" to document specific uses/finding/benefits as a by-product of the LSA process.

Recommendation

The 1987 Defense Budget line items acquisition programs at over \$86 billion. Sources interviewed and literature reviewed indicated LCC costs often run 3-5 times the acquisition costs of systems. On the low side, the current Defense Budget acquisitions will cost \$258 billion (3 x \$86) over the various life cycles.

Sources interviewed indicated that the actual cost of performing LSA was 1.5 to 3% the acquisition cost of a system. On the low side, if LSA were applied to all systems across DoD this would amount to an investment of \$1.29 billion (1.5% x \$86 billion, 1987 Defense Acquisition Budget). If these estimates are even near accurate, LSA would have to generate LCC benefit in the \$2-4 billion range (adjusting for time value of money -- current expenditures versus future savings) or roughly 1.5 - 2% of the current Defense Acquisition Budget LCC to pay for itself -- currently there is limited documentation to support the LSA investment or substantiate documentation to quantify such savings.

Our recommendations, based on the potential magnitude of LSA dollar investment and the study results are:

1. The linking of LSA to LCC be modeled as described above and briefed during the Phase II briefing (Attachment 3).
2. The effort be elevated to a DoD or Joint Service initiative to gain the greatest benefits and visibility needed to prevent further fragmentation of LSA initiatives.

3. The results of the above effort be documented in a user's guide that simplifies the decision and implementation process for hands-on LSA worker level personnel.
4. Contractual language be structured to provide:
  - a. Separate and distinct costing of the LSA within the Contract Line Item (CLIN) structure Work Breakdown Structure (WBS) to obtain visibility and tracking of any costs/performance;
  - b. Benefits tracking; and
  - c. Opportunity for contractor inputs to tailoring prior to award -- e.g., as part of draft RFPs.

#### Acknowledgements

The CACI team wishes to thank those individuals that contributed directly or indirectly to the inputs to this study. We wish to thank especially Mr. Robert Bowes, ESD Hanscom AFB, for the level of professionalism and support he provided during the course of this study. Mr. Bowes helped in setting up meetings, arranging contact points, and provided general guidance that was invaluable in the conduct of this study.

ATTACHMENT 1

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ATTACHMENT 2





**DEPARTMENT OF THE AIR FORCE**  
**HEADQUARTERS AERONAUTICAL SYSTEMS DIVISION (AFSC)**  
**WRIGHT-PATTERSON AIR FORCE BASE, OHIO 45433-6503**

**REPLY TO  
ATTN OF:**

ASD/PMRRA (Margaret J. Gillam, 513/255-5830)

4 Mar 87

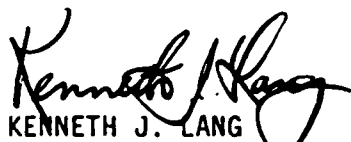
**SUBJECT:**

Contract No. F33615-86-C-5022, "Cost Effective Application of Logistics Support Analysis"

**TO:**

CACI, Inc.-Federal  
Attn: Mr Harry J. Rodas  
8260 Willow Oaks Corp. Drive  
Fairfax, VA 22031

1. Reference is made to paragraph 4.2.5 of Section C, Description/ Specifications of the subject contract.
2. You are hereby informed that the Air Force Business Research Management Center, at the present time, does not intend to proceed beyond Phase II of the subject contract. This decision is based in part through monthly status reports received from CACI and several conversations that the Business Research Management Center had with the technical sponsor. It appears to them that data to effectively pursue the goals of the Statement of Work Phase III cannot be obtained. Therefore, you must not expend any effort beyond that required for satisfactory completion of Phase II.
3. In addition, request you confirm, in writing, the price to complete the effort through Phase II, as shown in your Best and Final Offer (BAFO) of 19 Sep 86, to be \$83,496.00. Your reply to this letter is requested by 18 Mar 87.
4. Should you have any questions, please contact the undersigned or Margaret J. Gillam at 513/255-5830.

  
KENNETH J. LANG  
Contracting Officer

cc: AFBRMC/RDCB (Capt D. Smith)  
HQ ESD/PLLM (Mr Bowes)

ATTACHMENT 3

# **COST EFFECTIVE APPLICATION OF LOGISTICS SUPPORT ANALYSIS**

## **PHASE II BRIEFING (CDRL#3)**

**Prepared for:**

**Aeronautical Systems Division  
Wright-Patterson AFB, Ohio 45433-6503**

**and**

**Presented to ESD, Hanscom AFB - 16 March 1987**

**CONTRACT NO. F33615-86-C-5022**

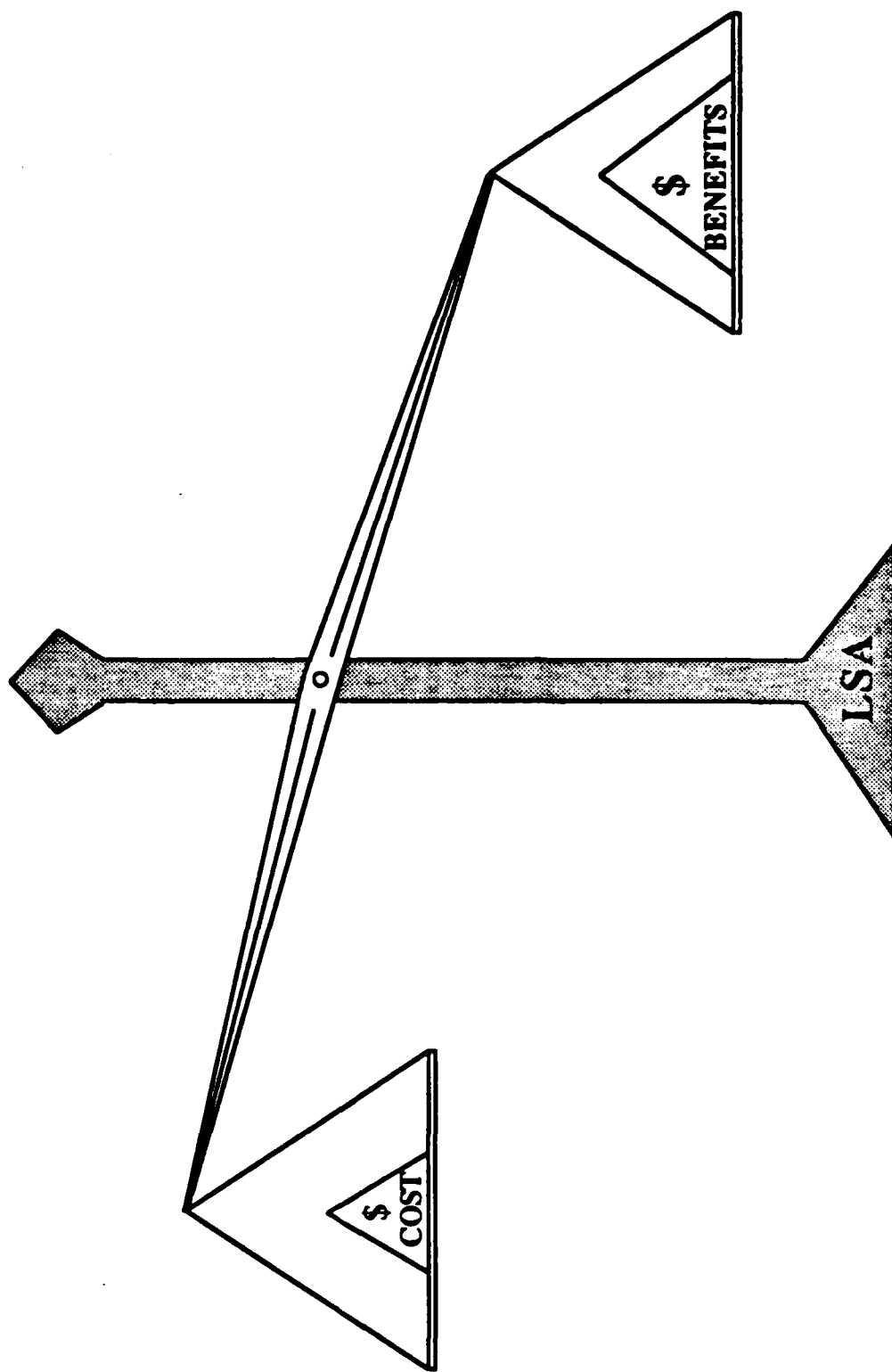
**Submitted by:**

**CACI, INC.-FEDERAL  
19 Firstfield Road  
Gaithersburg, Maryland 20878**

**16 March 1987**

**UNCLASSIFIED**

# LOGISTICS SUPPORT ANALYSIS



# ***SUBJECTS***

- CHARTER
- PHASES
  - PHASE I
  - PHASE II
  - PHASE III
- PROBLEM SOLUTION APPROACH
- PRELIMINARY RESULTS
- PRELIMINARY RECOMMENDATIONS

# *CHARTER*

**- CONDUCT RESEARCH INTO A METHODOLOGY  
FOR MEASURING COST/BENEFITS  
OF APPLYING THE FORMAL LOGISTIC  
SUPPORT ANALYSES OF MIL-STD-1388  
TO A SYSTEM OR EQUIPMENT ACQUISITION**

# *PHASES*



- PHASE I
  - ORGANIZE THE APPROACH
- PHASE II
  - RESEARCH
- PHASE III
  - DEVELOP A METHODOLOGY

# *PHASE I*

- UPDATE THE MANAGEMENT PLAN
- THINK THROUGH THE APPROACH
- DIALOGUE WITH GOVERNMENT PERSONNEL

## *PHASE II APPROACH*

**- LITERATURE RESEARCH**

**-- 108 DOCUMENTS**

**--- TYPICALLY SUGGEST WHAT WILL  
MAKE THE LSA PROCESS MORE  
EFFECTIVE, BUT OFFER NO  
INSIGHTS INTO THE LARGER  
PROBLEM OF COST/BENEFITS.**

**- CONTACTS**

**-- 23 PERSONS**

**--- TYPICALLY VIEW THE LSA  
PROCESS AS "VALUABLE", BUT  
OFFER NO SPECIFIC COUNSEL  
REGARDING COST/BENEFITS  
DETERMINATION.**

# *PHASE III APPROACH*

- USE LIFE CYCLE COST (LCC) METHODS
  - GOOD BASIS FOR TOTAL COST DETERMINATION
  - ACCEPTED METHOD FOR EVALUATING "WHAT IF" QUESTIONS
  - GO FROM KNOWN TO UNKNOWN
  - SEVERAL LCC COMPUTER MODELS AVAILABLE
  - ENABLE QUANTITATIVE COMPARISONS
  - REVEAL "DRIVERS" OF TOTAL LCC
    - ENABLE CALCULATION OF RELATIVE IMPORTANCE OF "DRIVERS"



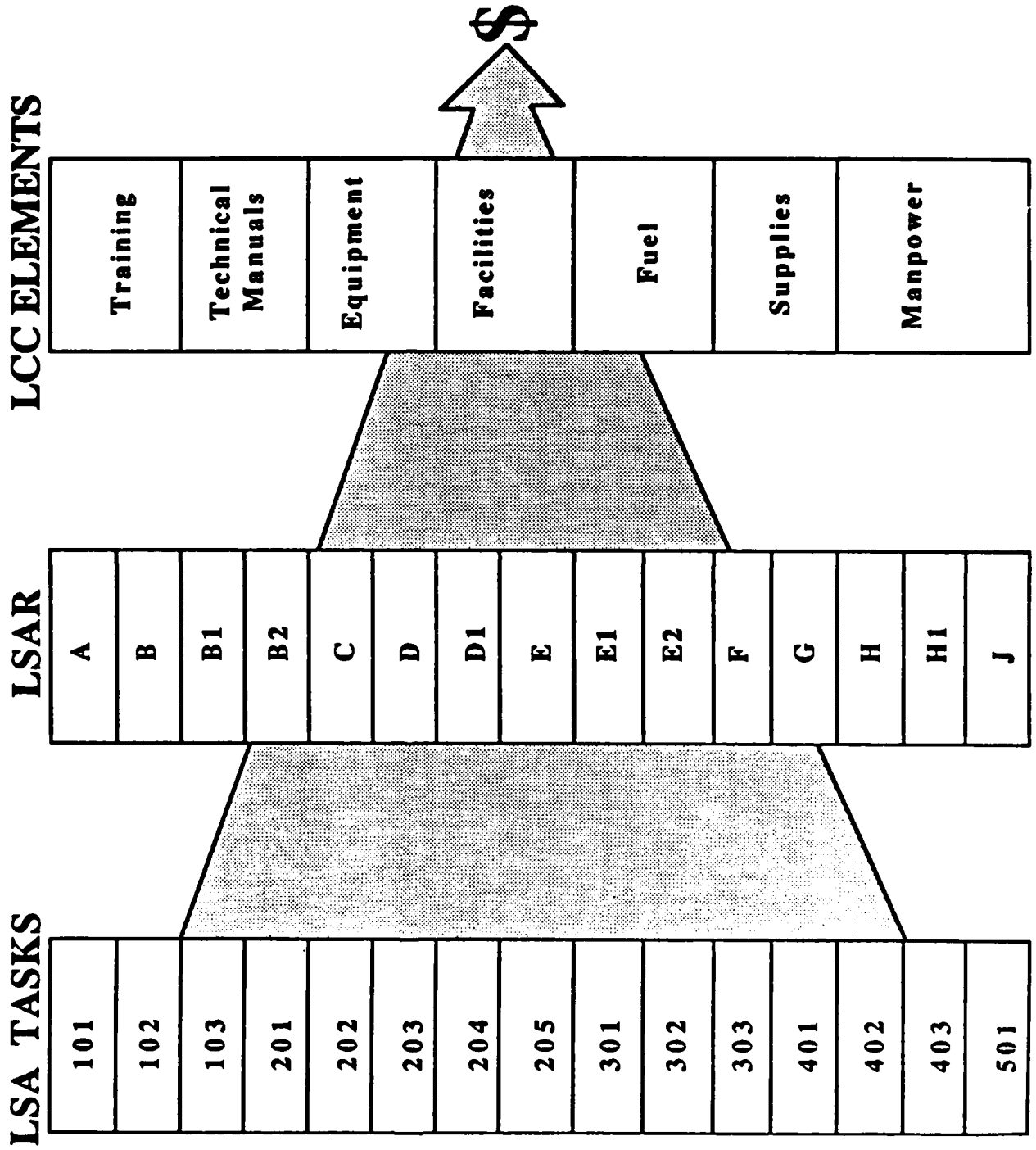
- LINK LCC ELEMENTS TO LSAR DATA ELEMENTS
- HELP LOCATE DUPLICATIONS OF EFFORT
- HELP REDUCE (OR EXPAND) LSAR DATA ELEMENTS
- SPECIFIC LSAR DATA ELEMENT "HEADS"  
WOULD HAVE SPECIFIC LCC "TAILS"
- LCC "TAILS" WITHOUT "HEADS" OR VICE VERSA  
INDICATE A BREAK IN THE LINK

- LINK LSAR DATA ELEMENTS TO LSA TASK
- HELP LOCATE GAPS IN LSAR-LSA TASK CHAIN
- ENABLE LINK TO BE ESTABLISHED IF NONE EXISTS
- ENABLE EVALUATION OF LSA TASK

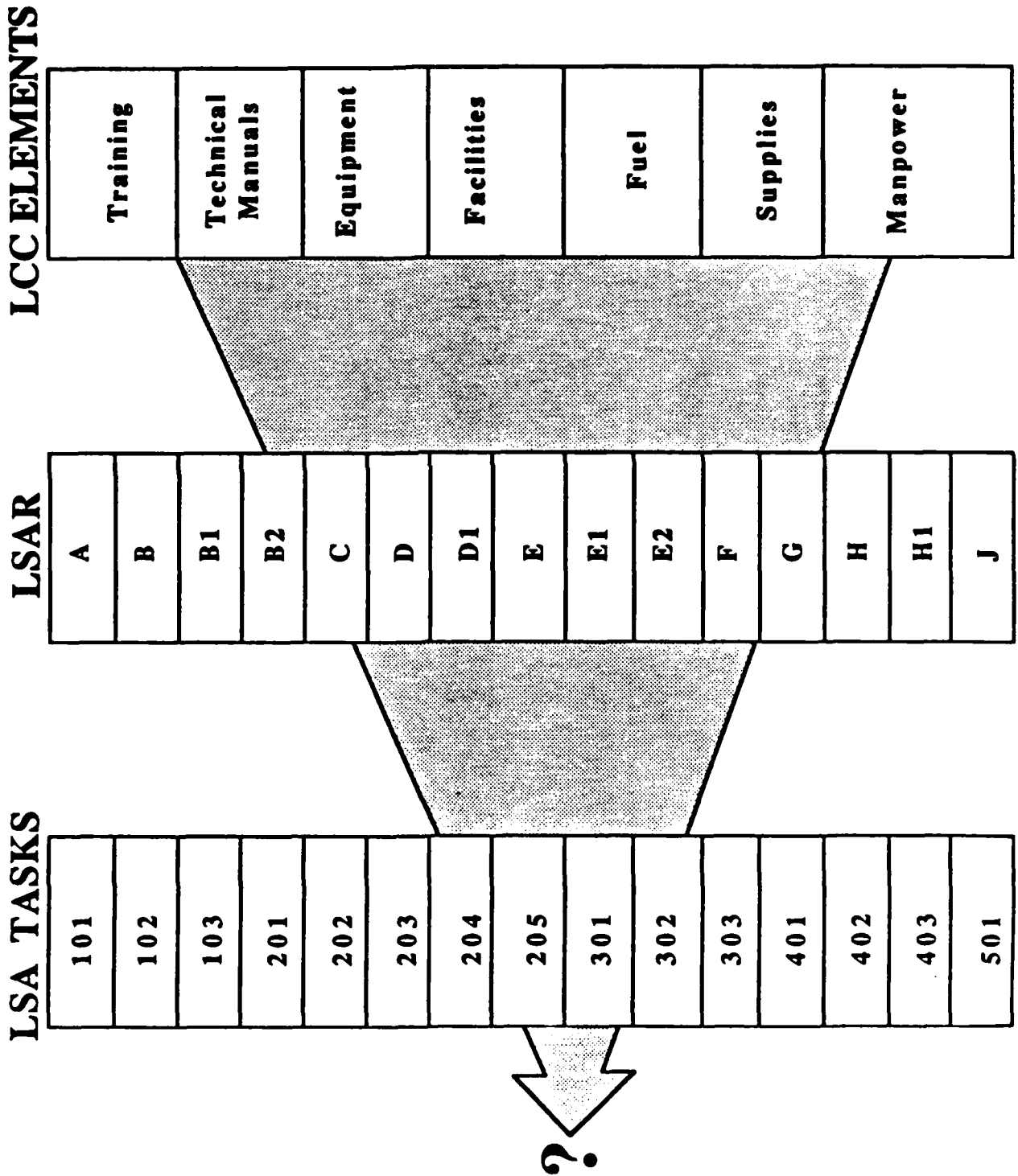
- STUDY LSA TASK>LSAR>LCC CHAIN
  - ENABLES DETERMINATION OF RELATIVE IMPORTANCE OF LSA TASK TO LCC
    - WOULD SUGGEST WHICH LSA TASKS MERIT A GREATER SHARE OF THE CONTRACT DOLLAR
      - DO NOT SPEND MUCH ON LSA TASKS WITH SMALL IMPACT ON LCC OUTPUT
  - ENABLES USE OF STATISTICAL ANALYSES
    - MULTIPLE REGRESSION
    - DISCRIMINANT ANALYSIS
    - CURVILINEAR REGRESSION

# *PROBLEM SOLUTION APPROACH*

# A TYPICAL APPROACH



# THE PROBLEM



- SOLVING THE PROBLEM

-- MODEL THE CONCEPT

--- MIDAS

---- TEST LSA TASK TO LCC  
OUTPUT CHAIN

---- USE SUBJECTIVE DATA

--- USE "LIVE" DATA

---- FURTHER TEST LSA TASK  
TO LCC OUTPUT CHAIN

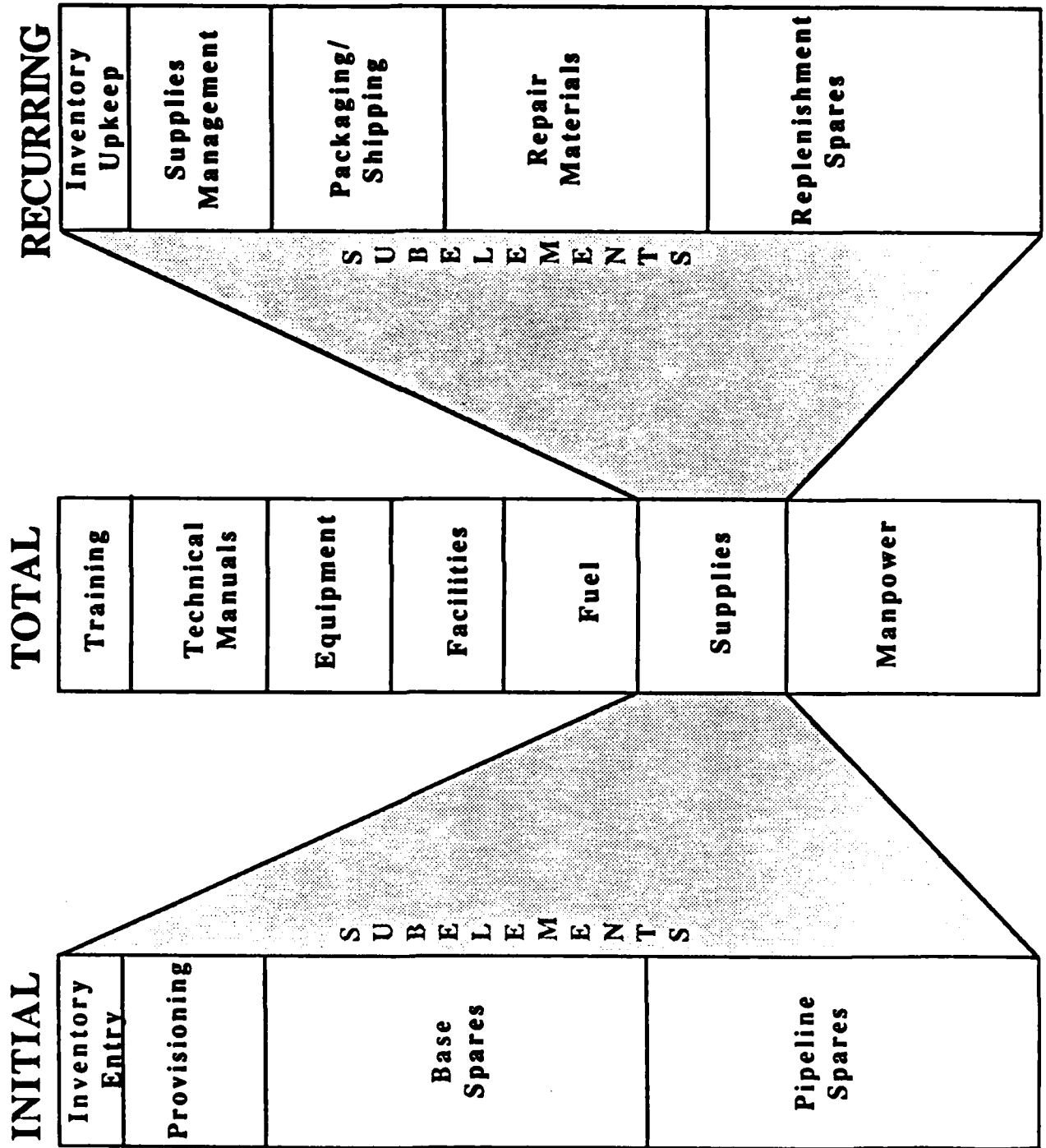
# ***ELEMENTS OF COST***

## **TOTAL**

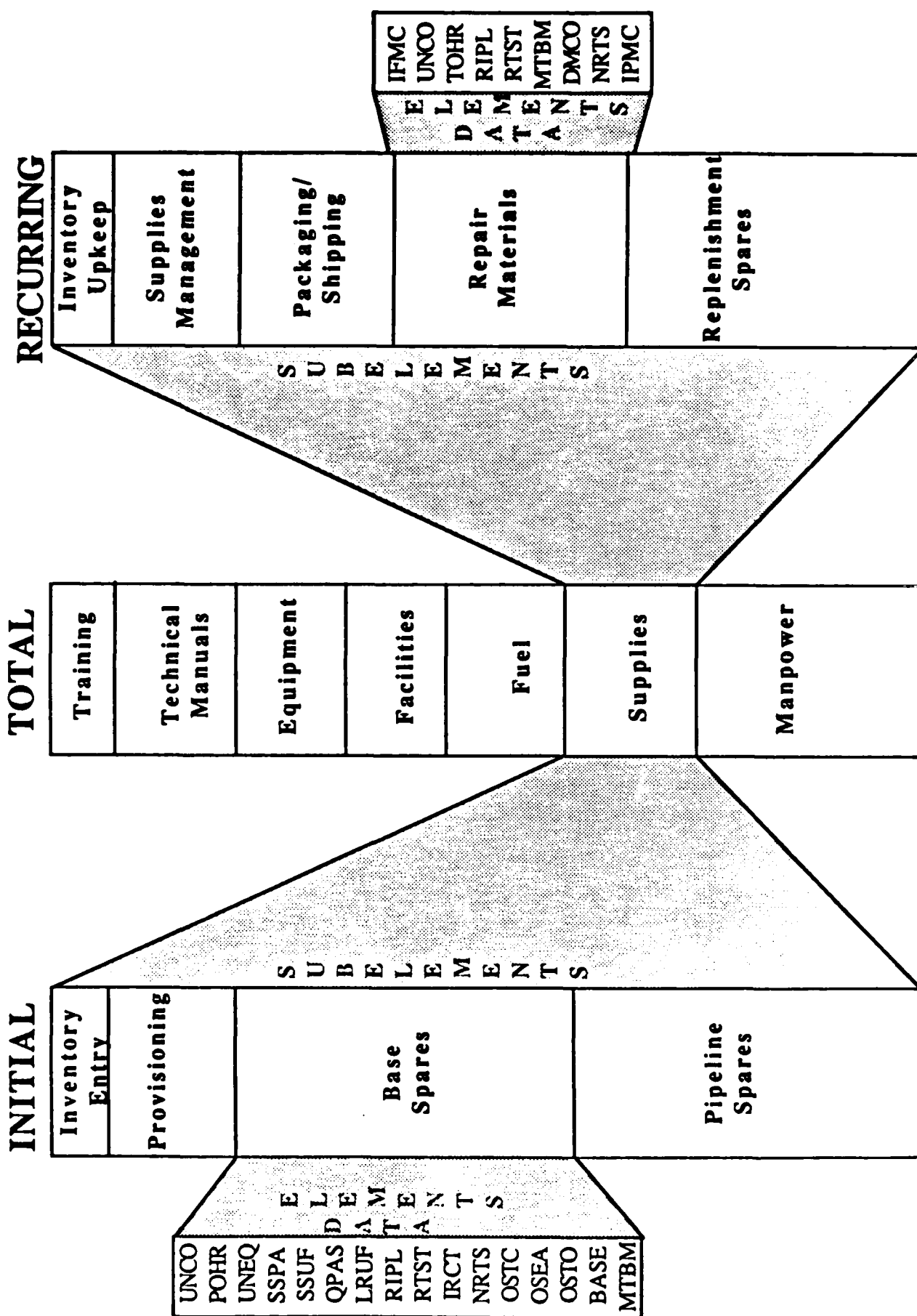
<b>Training</b>
<b>Technical Manuals</b>
<b>Equipment</b>
<b>Facilities</b>
<b>Fuel</b>
<b>Supplies</b>
<b>Manpower</b>



# ELEMENTS OF COST



# ELEMENTS OF COST



# LINKAGE

Life Cycle Cost Data Elements		LSAR (OTHER) DATA SOURCE		
Code	Translation	Sheet	Card	Block(s)
TOHR	Total Operating Hours	A	06	3
POHR	Peak Operating Hours	A	06	3/9
UNEQ	Number Operating Systems	A	06	15
BASE	Number Operating Locations	A	06	17
OSEA	Number Overseas Locations	A	06	17
OSTC	Order/Ship Time CONUS	(AFLCR 173-10)		
OSTO	Order/Ship Time Overseas	(AFLCR 173-10)		
IRCT	Intermediate Repair Cycle Time	(AFLCR 173-10)		
MTBM	Mean Time Between Maintenance	H	13	6
RIPL	Percent On-Equipment Repair	B	07	5
DMCO	Depot Material Cost	C	06	3
IFMC	Intermediate Material Cost	D	07	3/5/7/9
IPMC	On-Equipment Material cost	H	02	6/7
UNCO	Unit Cost	D	07	3/5/7/9
QPAS	Quantity Per Assembly	H	02	6/7
RTST	Percent Intermediate Repair	H	02	6/7
NRTS	Percent Sent to Depot	H	02	6/7
SSPA	Subsystems Per System	H	02	6/7
SSUF	Subsystem Utilization Factor	H	02	6/7
LRUF	LRU Utilization Factor	H	02	6/7
		A	03	7
		C	03	17
			(LSACIL)	12
				8
				5
				5

\* = Derived From

LSA (OTHER) TASKS

201.2.1/2

Identify/Document  
Intended Use Factors

202.2.1/2

Identify/Provide  
Standard Information

401.2.1/2

Conduct/Document  
Task Analyses

401.2.8

Document Provisioning  
Technical Documentation

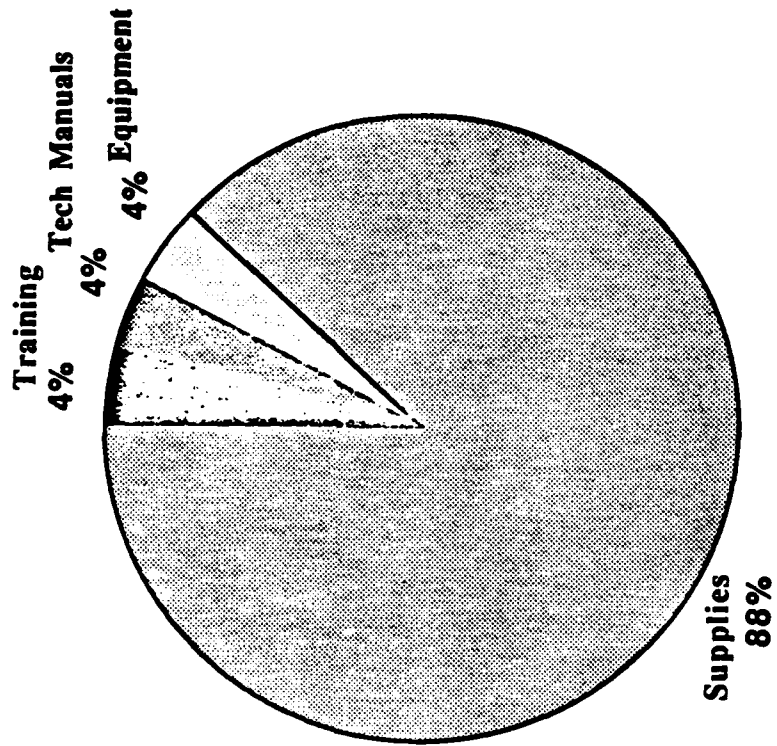
(Engineering Analysis)

## "AFFECTABLES"

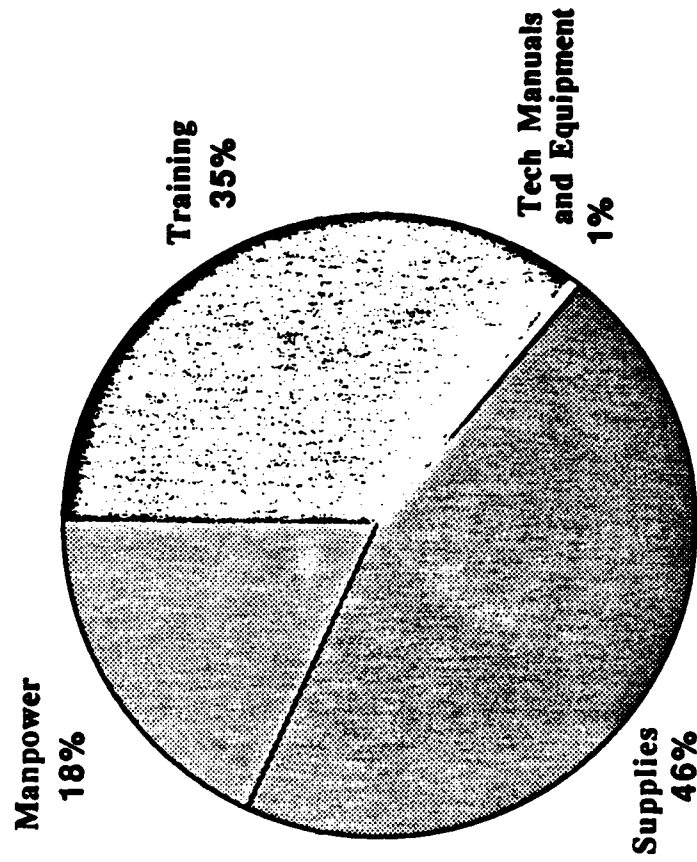
Life Cycle Cost Data Elements		LSA (Other) Tasks	Responsible	Affectability
Code	Translation			
TOHR	Total Operating Hours	201.2.1/2	Government	None
POHR	Peak Operating Hours			
UNEQ	Number Operating Systems			
BASE	Number Operating Locations			
OSEA	Number Overseas Locations			
OSTC	Order/Ship Time CONUS	202.2.1/2	Contractor	Little or None - Cost Transfers
OSTO	Order/Ship Time Overseas			
IRCT	Intermediate Repair Cycle Time			
SSPA	Subsystems Per System	(Engineering Analysis)		
SSUF	Subsystem Utilization Factor			
LRUF	LRU Utilization Factor			
UNCO	Unit Cost	401.2.1/2		
QPAS	Quantity Per Assembly			
DMCO	Depot Material Cost			
IFMC	Intermediate Material Cost			
IPMC	On-Equipment Material Cost			
MTBM	Mean Time Between Maintenance	401.2.8		
RIPL	Percent On-Equipment Repair			
RTST	Percent Intermediate Repair			
NRTS	Percent Sent to Depot			

# *PRELIMINARY RESULTS*

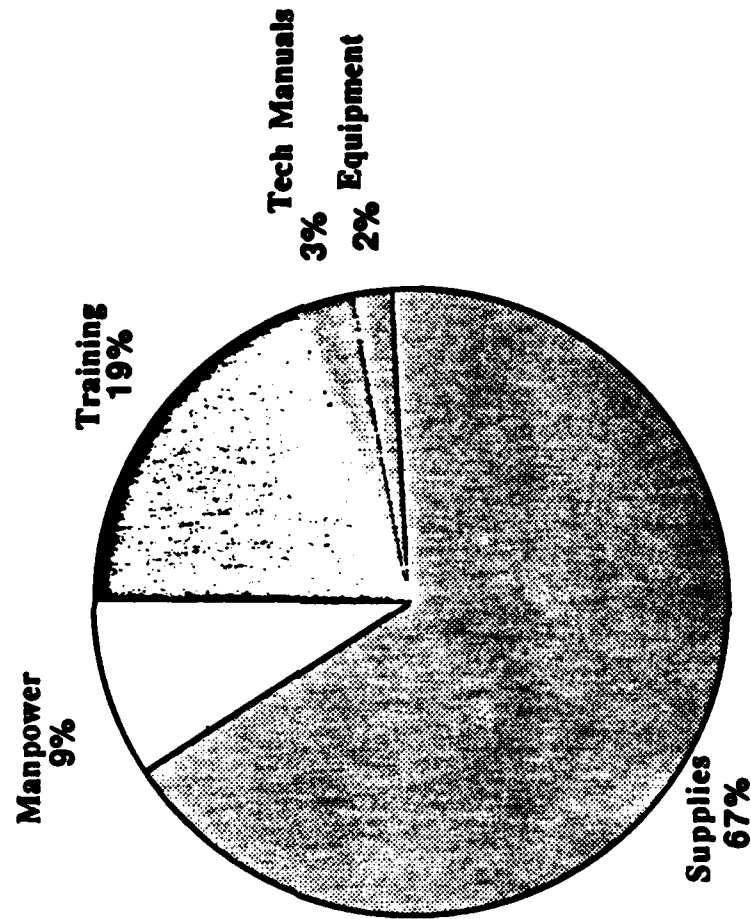
**Total Costs**  
**(Initial)**



**Total Costs**  
**(Recurring)**

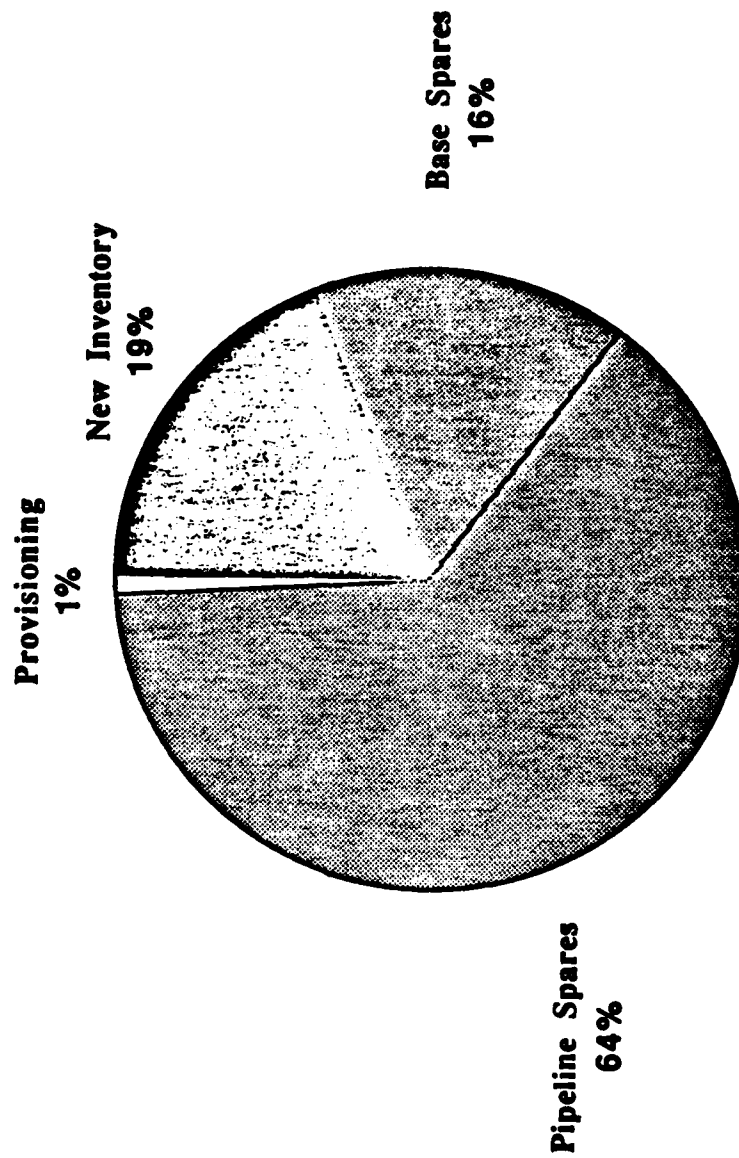


**Total Costs**  
**(Initial and Recurring)**

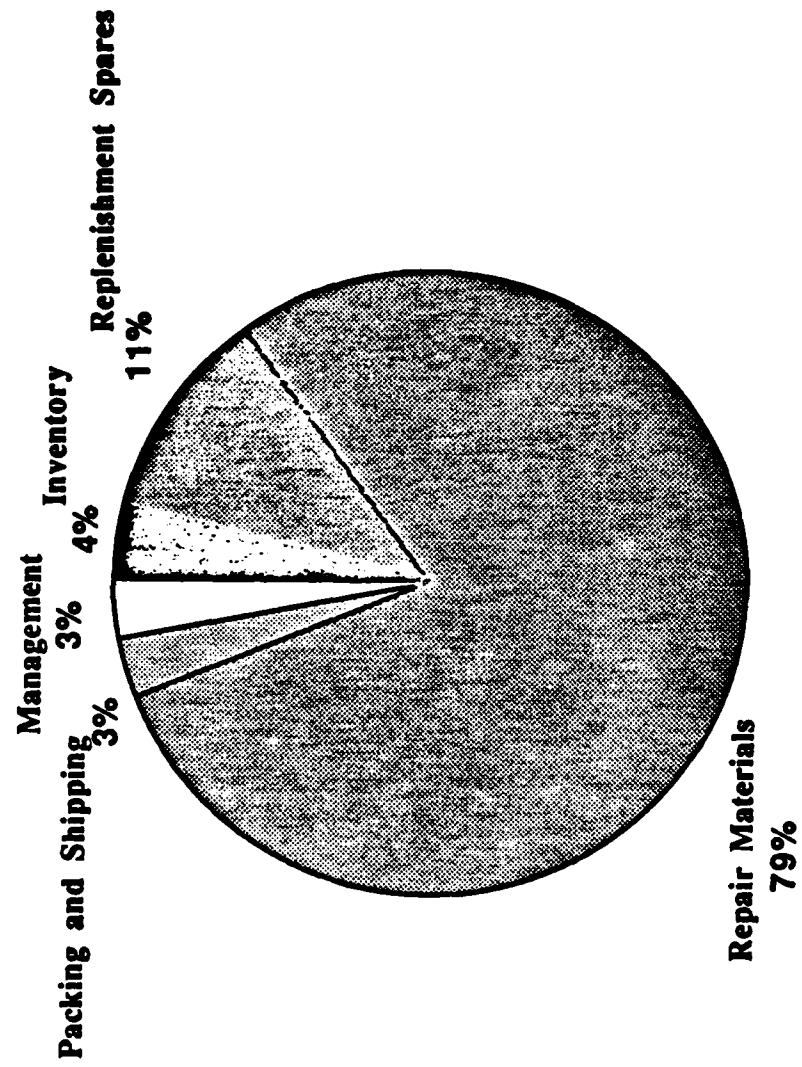




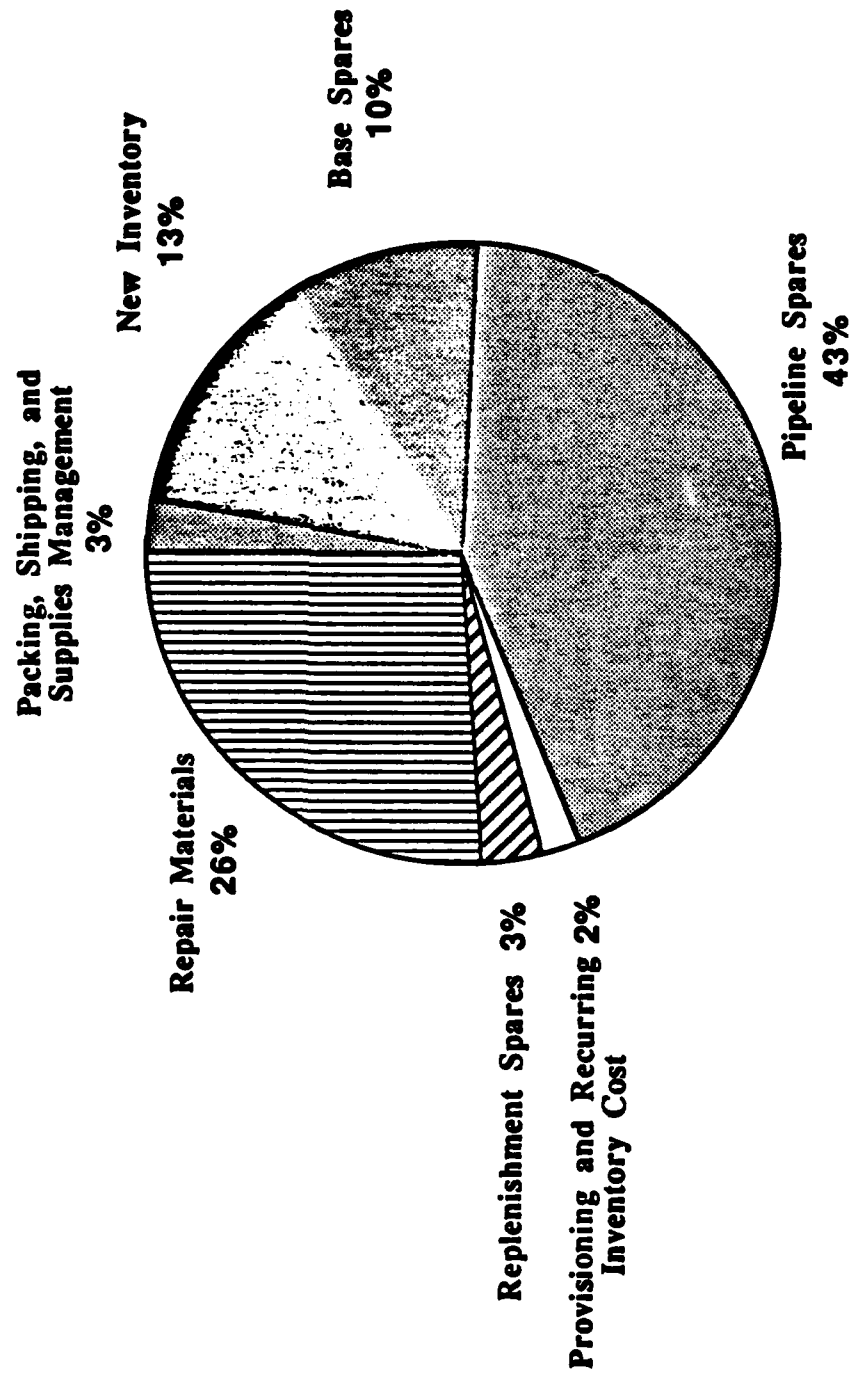
**Total Supplies Costs**  
**(Initial)**



**Total Supplies Costs**  
**(Recurring)**



**Total Supplies Costs**  
**(Initial and Recurring)**



***PRELIMINARY RECOMMENDATIONS***

**- IN GENERAL, LSA REQUIRES:**

- DEDICATED SUPERVISION**
- TECHNICALLY COMPETENT SUPERVISION**
- A METHOD TO GAUGE EFFECTIVENESS OF THE PROCESS**
- MEETINGS WITH CONTRACTOR 30-45 DAYS AFTER CONTRACT AWARD**
- ANALYSTS WHO UNDERSTAND SALIENT FEATURES OF:**

- ENGINEERING**
- SPARES**
- SUPPORT**
- TRAINING**
- MANPOWER**
- MAINTENANCE**

- RFPs SHOULD
  - POSSESS STATEMENTS SUCH AS "LSA WILL BE EVALUATED FOR PRICE REALISM"
  - POSSESS STATEMENTS CONCERNING HOW LSA WILL BE USED IN THE DESIGN PROCESS
  - REQUEST CONTRACTORS RECOMMEND WHICH LSA TASKS SHOULD BE USED

- COST PROPOSALS SHOULD:
  - INCLUDE DETAILED BASIS OF ESTIMATES  
FOR LSA TASKS WHETHER USED OR NOT
  - BE EVALUATED BY LSA KNOWLEDGEABLE  
PEOPLE
- TECHNICAL PROPOSALS SHOULD:
  - INCLUDE LSA CANDIDATE ITEM LIST

- CONTRACTS SHOULD:
  - POSSESS A SEPARATE LINE ITEM TO  
COST ALL LSA WORK
  - POSSESS A "DELIVERABLE" TO DOCUMENT  
SPECIFIC USES/FINDINGS/BENEFITS  
ACHIEVED AS A BY-PRODUCT OF THE  
LSA PROCESS



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<p>The study consisted of a literature search, interviews with selected knowledgeable personnel, and program reviews to establish relationships between costs of performing Logistics Support Analysis (LSA) and benefits derived from resource inputs.</p>					
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